Claims

1. A composite structural material having an appearance similar to that of natural stone, said material comprising:

a natural aggregate,

a polymeric binder,

a curing agent, and

an antimicrobial agent.

2. A composite material according to claim 1 wherein said natural aggregate material is selected from the group consisting of calcium carbonate, marble, granite, quartz, feldspar, marble and quartzite and mixtures thereof.

3. A composite material according to claim 2 further comprising a filler selected from the group consisting of fumed silica, sand, clay, fly ash, cement, broken ceramics, mica, silicate flakes, broken glass, glass beads, glass spheres, mirror fragments, steel grit, aluminum grit, carbides, plastic beads, pelletized rubber, ground polymer composites, wood chips, sawdust, paper laminates, pigments, colorants, and mixtures thereof.

4. A composite material according to claim 2 wherein said natural aggregate material makes up between about 85% to about 96% by weight of the total composition.

5. A composite material according to claim 4 wherein said natural aggregate material makes up between about 89% to about 93% by weight of the total composition.

6. A composite material according to claim 4 wherein said polymeric binder makes up between about 4% to about 15% by weight of the total composition.

7. A composite material according to claim 6 wherein said polymeric binder makes up between about 6% to about 10% by weight of the total composition.

8. A composite material according to claim 1 wherein said polymeric binder is selected from the group consisting of monomers, a mixture of monomers, polymers, a mixture of polymers, and a mixture of monomers and polymers.

9. A composite material according to claim 8 wherein said polymeric binder is a polymer and is selected from the group consisting of thermoplastic polymers and thermosetting polymers.

10. A composite material according to claim 9 wherein said polymeric binder is a polymer and is selected from the group consisting of polyester, vinyl ester, epoxy, phenolic resin, urethane, and mixtures thereof.

11. A composite material according to claim 8 wherein said polymeric binder is a monomer and is selected from the group consisting of acrylics, styrene, styrene derivatives, vinyl toluene, divinyl benzene, methyl acrylate, ethyl acrylate, isopropyl acrylate, butyl acrylate, 2-ethylhexyl acrylate, methyl methacrylate, ethyl methacrylate, isopropyl methacrylate, butyl methacrylate, phenols, and furans.

12. A composite material according to claim 11 wherein said monomer is selected from the group consisting of styrene, methyl methacrylate and butyl acrylate.

13. A composite material according to claim 1 wherein said antimicrobial agent is selected from the group consisting of organic and inorganic antimicrobial agents.

14. A composite material according to claim 13 wherein said antimicrobial agent is organic and is present in said material in a quantity between about 500 ppm and 10,000 ppm.

15. A composite material according to claim 14 wherein said antimicrobial agent is organic and is present in said material in a quantity between about 800 ppm and 7000 ppm.

16. A composite material according to claim 14 wherein said antimicrobial agent is an organic antimicrobial agent and is selected from the group consisting of quarternary ammonium compounds, quarternary ammonium compounds having an unsaturated reactive group, metals, and antimicrobial agents exhibiting the ability to migrate through said polymeric binder.

17. A composite material according to claim 16 wherein said antimicrobial agent is selected from the group consisting of triclosan, tolyl diiodomethyl sulfone, zinc pyrithione, sodium pyrithione, ortho phenylphenol, sodium ortho phenylphenol, iodo-2-propynyl butylcarbamate, poly[oxyethylene(dimethyliminio) ethylene(dimethyliminio)ethylene chloride], propiconazole, tebuconazole, bethoxazin, thiabendazole, polyhexamethylene biguanide, and 1,3,5-triazine-1,3,5-(2H,4H,6H)-triethanol, isothiazalinones, and mixtures thereof.

18. A composite material according to claim 17 wherein said polymeric binder is polyester and said antimicrobial agent is triclosan, wherein said triclosan is present in the material in a quantity between about 800 ppm and 5000 ppm.

19. A composite material according to claim 13 wherein said antimicrobial agent is an inorganic agent and is selected from the group consisting of metal salts, ceramics containing metals, zeolites containing metals, and mixtures thereof.

20. A composite material according to claim 19 wherein said antimicrobial agent is selected from the group consisting of salts of silver, copper, zinc, mercury, tin, lead, bismuth, barium, cadmium, chromium, and mixtures thereof.

21. A composite material according to claim 20 wherein said antimicrobial agent contains silver and is selected from the group consisting of silver acetate, silver benzoate, silver carbonate, silver iodate, silver iodide, sliver lactate, silver laurate, silver nitrate, silver oxide, silver palmitate, silver sulfadiazine, ceramics containing silver, zeolites containing silver, and mixtures thereof.

22. A composite material according to claim 19 wherein said antimicrobial agent is present in the material in a concentration between about 1000 ppm and 50,000 ppm.

23. A composite material according to claim 21 wherein said binder is polyester and said antimicrobial agent is present in in the composition in a concentration between about 1000 ppm and 50,000 ppm.

24. A composite material according to claim 1 wherein said antimicrobial agent is present in an amount sufficient to demonstrate commercially acceptable efficacy against a microbe of concern.

25. A finished product comprising the composite material according to claim 1.

26. A finished product according to claim 25 selected from the group consisting of a tabletop, a countertop, architectural facings, walkways, home furnishings, patio furniture, decorative stone, indoor and outdoor tile, flooring, mantles, wall facings, bathroom fixtures, and imitation stone structures.

27. A composite material according to claim 1 further comprising a colorant.

28. A process for the manufacture of a composite structural material, the process comprising the steps of:

obtaining a natural aggregate of appropriate dimension;

combining the aggregate with a polymeric binder to form an aggregate and binder mixture;

adding an antimicrobial agent to the mixture;

distributing the mixture in a mold; and

curing the mixture by application of heat and pressure and vibration.

29. A process according to claim 28 wherein the natural aggregate is added in a quantity such that it makes up between about 85% to about 96% by weight of the total mixture.

30. A process according to claim 29 wherein the natural aggregate material makes up between about 89% to about 93% by weight of the total composition.

31. A process according to claim 28 wherein the step of obtaining the natural aggregate comprises obtaining aggregate selected from the group consisting of calcium carbonate, quartz, granite, feldspar, marble, quartzite, and mixtures thereof.

32. A process according to claim 31 further comprising the step of combining the aggregate with a filler selected from the group consisting of fumed silica, sand, clay, fly ash, cement, broken ceramics, mica, silicate flakes, broken glass, glass beads, glass spheres, mirror fragments, steel grit, aluminum grit, carbides, plastic beads, pelletized rubber, ground polymer composites, wood chips, sawdust, paper laminates, pigments, colorants, and mixtures thereof.

33. A process according to claim 31 wherein the aggregate is selected from the group consisting of granite, marble, quartz and mixtures thereof.

34. A process according to claim 28 wherein the polymeric binder is combined with the aggregate in a quantity such that it makes up between about 4% to about 15% by weight of the total mixture.

35. A process according to claim 34 wherein said polymeric binder makes up between about 6% to about 10% by weight of the total mixture.

36. A process according to claim 28 wherein said polymeric binder is selected from the group consisting of monomers, a mixture of monomers, polymers, a mixture of polymers, and a mixture of monomers and polymers.

37. A process according to claim 26 wherein said polymeric binder is a polymer and is selected from the group consisting of thermoplastic polymers and thermosetting polymers.

38. A process according to claim 37 wherein said polymeric binder is a polymer and is selected from the group consisting of polyester, vinyl ester, epoxy, phenolic resin, urethane, and mixtures thereof.

39. A process according to claim 36 wherein said polymeric binder is a monomer and is selected from the group consisting of styrene, styrene derivatives, vinyl toluene, divinyl benzene, methyl acrylate, ethyl acrylate, isopropyl acrylate, butyl acrylate, 2-ethylhexyl acrylate, methyl methacrylate, ethyl methacrylate, isopropyl methacrylate, butyl methacrylate, phenols, and furans.

40. A process according to claim 39 wherein said monomer is selected from the group consisting of styrene, methyl methacrylate and butyl acrylate.

41. A process according to claim 34 wherein the polymeric binder is polyester.

42. A process according to claim 28 further comprising the step of placing the aggregate and binder mixture under a vacuum.

43. A process according to claim 42 wherein the vacuum is maintained as the mixture is distributed into the mold.

44. A process according to claim 28 wherein the step of curing the mixture under pressure comprises the application of a vacuum.

45. A process according to claim 42 wherein the curing step comprises the application of heat between ambient and about 200°C.

46. A process according to claim 28 wherein said applied pressure is between about 70 tons and about 140 tons.

47. A process according to claim 28 wherein the step of adding an antimicrobial agent to the aggregate and binder mixture comprises adding the antimicrobial agent directly to the aggregate and binder mixture.

48. A process according to claim 28 wherein the step of adding the antimicrobial agent to the aggregate and binder mixture comprises adding the antimicrobial agent to the binder prior to combining the aggregate with the binder.

49. A process according to claim 28 wherein the step of adding the antimicrobial agent to the aggregate and binder mixture comprises combining the antimicrobial agent with a colorant and then adding the antimicrobial agent and colorant to the aggregate binder mixture.

50. A process according to claim 28 wherein the step of adding the antimicrobial agent comprises adding the antimicrobial agent to a polymeric layer adjacent an outer surface of the cured mixture.

51. A process according to claim 28 wherein the antimicrobial agent is selected from the group consisting of organic and inorganic agents.

52. A process according to claim 51 wherein the antimicrobial agent is organic and is added in an amount sufficient to constitute between about 500 ppm and 10,000 ppm of the total mixture.

53. A process according to claim 52 wherein the antimicrobial agent is organic and is between about 800 ppm and 7000 ppm of the total mixture.

54. A process according to claim 52 wherein the antimicrobial agent is an organic antimicrobial agent and is selected from the group consisting of quarternary ammonium compounds, quarternary ammonium compounds having an unsaturated reactive group, metals, and antimicrobial agents exhibiting the ability to migrate through said polymeric binder, and mixtures thereof.

55. A process according to claim 54 wherein the antimicrobial agent is selected from the group consisting of triclosan, tolyl diiodomethyl sulfone, zinc pyrithione, sodium pyrithione, ortho phenylphenol, sodium ortho phenylphenol, iodo-2-propynyl butylcarbamate, poly[oxyethylene(dimethyliminio) ethylene(dimethyliminio)ethylene chloride], propiconazole, tebuconazole, bethoxazin, thiabendazole, polyhexamethylene biguanide, and 1,3,5-triazine-1,3,5-(2H,4H,6H)-triethanol, isothiazalinones and mixtures thereof.

56. A composite material according to claim 55 wherein the polymeric binder is polyester and the antimicrobial agent is triclosan, wherein the triclosan is present in the material in a quantity between about 800 ppm and 5000 ppm.

57. A process according to claim 51 wherein the antimicrobial agent is an inorganic agent and is selected from the group consisting of metal salts, ceramics containing metals, zeolites containing metals, and mixtures thereof.

58. A process according to claim 57 wherein the antimicrobial agent is selected from the group consisting of salts of silver, copper, zinc, mercury, tin, lead, bismuth, barium, cadmium, chromium, and mixtures thereof.

59. A process according to claim 2.24 wherein the antimicrobial agent contains silver and is selected from the group consisting of silver acetate, silver benzoate, silver carbonate, silver iodate, silver iodide, sliver lactate, silver laurate, silver nitrate, silver oxide, silver palmitate, silver sulfadiazine, ceramics containing silver, zeolites containing silver, and mixtures thereof.

60. A process according to claim 57 wherein said antimicrobial agent is added to the mixture to constitute a concentration between about 1000 ppm and 50,000 ppm of the total mixture.

61. A process according to claim 59 wherein said binder is polyester and said antimicrobial agent is present in in the composition in a concentration between about 1000 ppm and 50,000 ppm.

62. A process according to claim 51 wherein said antimicrobial agent is present in an amount sufficient to demonstrate commercially acceptable efficacy against a microbe of concern.

63. A process according to claim 28 wherein said binder comprises a polyester and said antimicrobial agent is triclosan and the triclosan present in the cured mixture is between about 800 ppm and about 5000 ppm based upon the weight of the cured mixture.

64. A process according to claim 28 further comprising forming a finished product from the cured mixture.

65. A process according to claim 64 wherein the step of forming a finished product comprises forming a tabletop, a countertop, architectural facings, walkways, home furnishings, patio furniture, decorative stone, indoor and outdoor tile, flooring, mantles, wall facings, bathroom fixtures, cutting boards, sinks, showers, tubs, and imitation stone structures.